

# **MSFC Telescience Support Center Requirements Document**

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**TSC-RQMT-002**

**September 2000**

**Baseline**



National Aeronautics and  
Space Administration

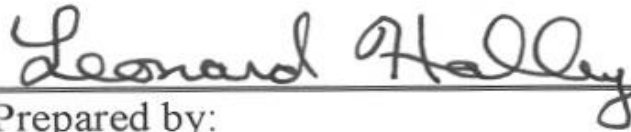
**Marshall Space Flight Center**  
Huntsville, Alabama

**MSFC Telescience Support Center (TSC)**

**ISS Telescience Requirements Document**

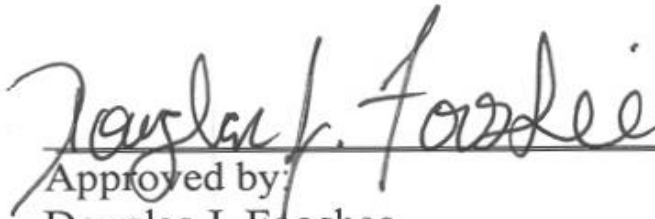
**TSC-RQMT-002**

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Prepared by:

Leonard Halley, Book Manager  
Lockheed-Martin, UMS



Approved by:

Douglas J. Fooshee  
Systems Engineer  
Ground Systems Department  
Flight Projects Directorate



Approved by:

Tim Owen  
Project Manager  
Telescience Support Center  
Microgravity Science and Applications Department  
Science Directorate

**Change Record**

<b>Rev. No.</b>	<b>Date</b>	<b>Originator/Phone</b>	<b>Description</b>

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## **1 INTRODUCTION**

This NASA George C. Marshall Space Flight Center (MSFC) Telescience Support Center (TSC) Requirements Document establishes the minimum requirements necessary to support payload operations. The MSFC TSC provides a facility for the Microgravity Science and Applications Department (MSAD) Disciplines and their associated payloads of the Microgravity Research Program. These disciplines are Materials Science, Biotechnology Science and the Glovebox Office.

### **1.1 Scope**

The scope of this document includes MSFC TSC requirements necessary to support Microgravity Material Science, Biotechnology Science, and the Glovebox Office in support of the ISS Program. TSC requirements are driven by the International Space Station Program Office (ISSPO), the International Ground Segment Specification (IGSS) SSP-54500, Payload Operations and Integration Center (POIC), the Microgravity Research Program Office, the MSAD, the MSAD Disciplines and by the individual payload Developers.

### **1.2 Purpose**

The purpose of this document is to serve as the single source document for all the requirements on the MSFC TSC.

### **1.3 Change Process**

The TSC Requirements Document is managed by the TSC Project Control Board. New capabilities, upgrades and enhancements require submission of an Engineering Change Request (ECR) to the TSC Project Control Board for disposition. Upon approval of the ECR, the TSC Requirements Document and the TSC Capabilities Document will be updated.

### **1.4 Precedence**

The TSC Requirements Document is the governing document for the requirements of the TSC Facility. The TSC Capabilities Document reflects the current state of the implementation of TSC Requirements. Though they are companion documents, the TSC Requirements Document takes precedence over the TSC Capabilities Document as well as any other lower level TSC configuration document.

## **2 REFERENCES**

### **2.1 Reference Documents**

Reference documents are those documents that although not part of this document, serve to amplify or clarify its contents or dictate work policy or procedure.

- POIC Capabilities Document SSP-50304
- TSC Capabilities Document TSC-HDBK-001
- MSFC Security Procedures and Guidelines MPG 1600.1
- Information Technology Security MPG 2810.1

### **2.2 Applicable Documents**

Applicable documents are documents of the most current issue whose content to the extent specified herein are considered to form part of this document. The specified documents carry the same weight as if they were stated within the body of this document.

- International Ground Segment Specification SSP-54500
- POIC Generic User Interface Definition Document SSP-50305
- Enhanced Mission Communication System Requirements  
MSFC-PLAN-2436
- Enhanced Mission Communication System Requirements  
MSFC-PLAN-2437 (Vol 1-3)

### **3 SYSTEMS DESCRIPTION**

The TSC facility supports activities that include controlling onboard experiments, analyzing, processing and distributing science data, troubleshooting problems, and training TSC ground personnel. Additionally, the TSC facility provides user connectivity to the POIC Voice, Video and Data Systems to allow for coordination and cognizance of mission activities. Requirements in this document are applicable only to systems or services within the TSC, unless otherwise specified.

The Microgravity Development Lab (MDL) in building 4493 houses the MSFC TSC. Figure 3-1 illustrates the layout of the MDL and the location of the MSFC TSC and the High Bay / Clean Room within the MDL. The TSC is located in rooms 120, 122, and 124, as indicated in Figure 3-1. Figure 3-2 shows the layout of the User Console Positions within the TSC. The High Bay / Clean Room, located in Room 140, console and disciplinary layout are depicted in Figure 3-3.

Figures on the following pages illustrate the basic functional connectivity of the various systems which comprise the TSC. These systems include:

- Overall TSC – Figure 3-4 shows the connectivity to interfaces external to the TSC.
- Voice System – Figure 3-5 shows the TSC voice terminal connectivity to the central voice distribution switch. The TSC voice system is an extension of the POIC voice system, which is described in MSFC-RQMT-2437 Vol. 1.
- Video System – Figure 3-6 shows the video system interconnectivity between the HOSC, TSC, and the 4207 Annex. Users in the TSC can select a video source from the 10 channels provided. One video channel can be fed back to the Annex, if required.
- Enhanced Mission Communication System (EMCS) – Figure 3-7 illustrates that the EMCS and the MSFC high-speed backbone are used to distribute data from within the center to the TSC.
- MSFC TSC Local Area Networks – Figure 3-8 depicts the two local area networks within the TSC: the TSC Mission Network and the Institutional Area Network (IAN). Network services include, but are not limited to, those listed on the drawing. The TSC Mission Network provides access to POIC telemetry, command and mission support services. The Institutional Area Network provides access to administrative services such as email and DDS applications.

#### **3.1 Data System**

No data system requirements are provided at this time.

#### **3.2 Timing System**

Wall clocks displaying a configurable event time, usually Greenwich Mean Time (GMT), are provided. One in each Operations room.

**Figure 3-1 Building 4493 Microgravity Development Lab With The TSC Highlighted**

# Microgravity Development Laboratory Building 4493 Layout

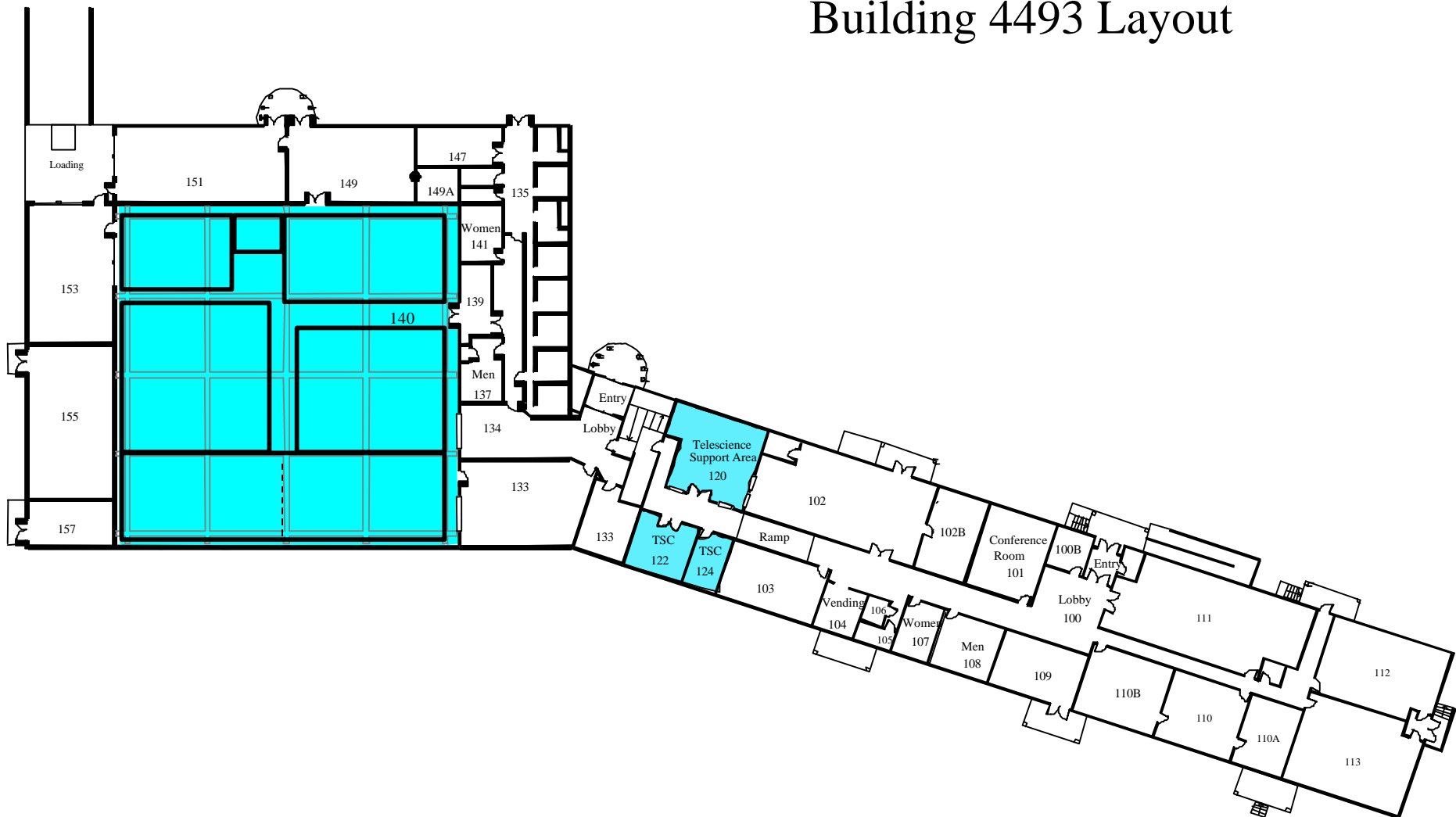




Figure 3-2 TSC Console Layout

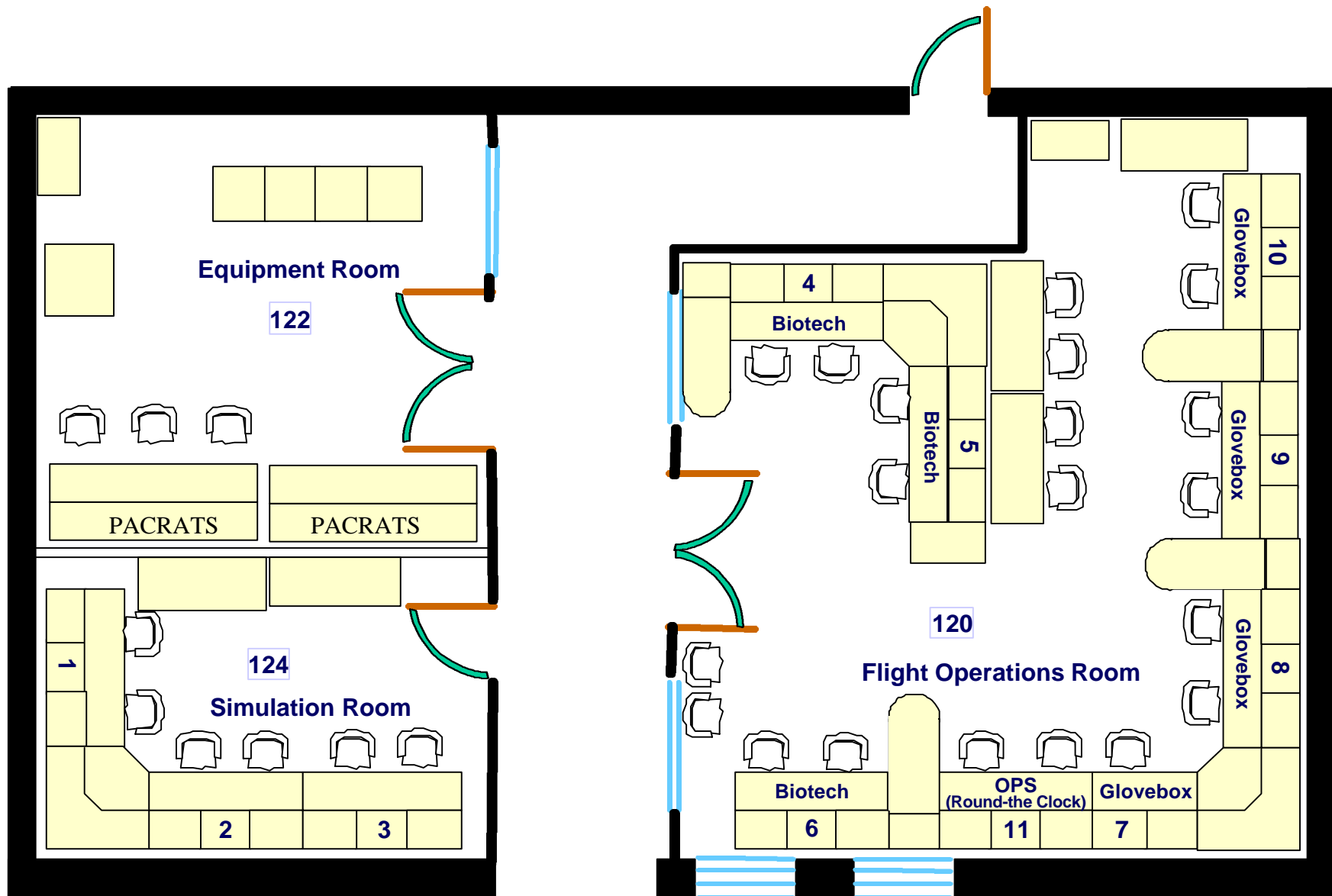
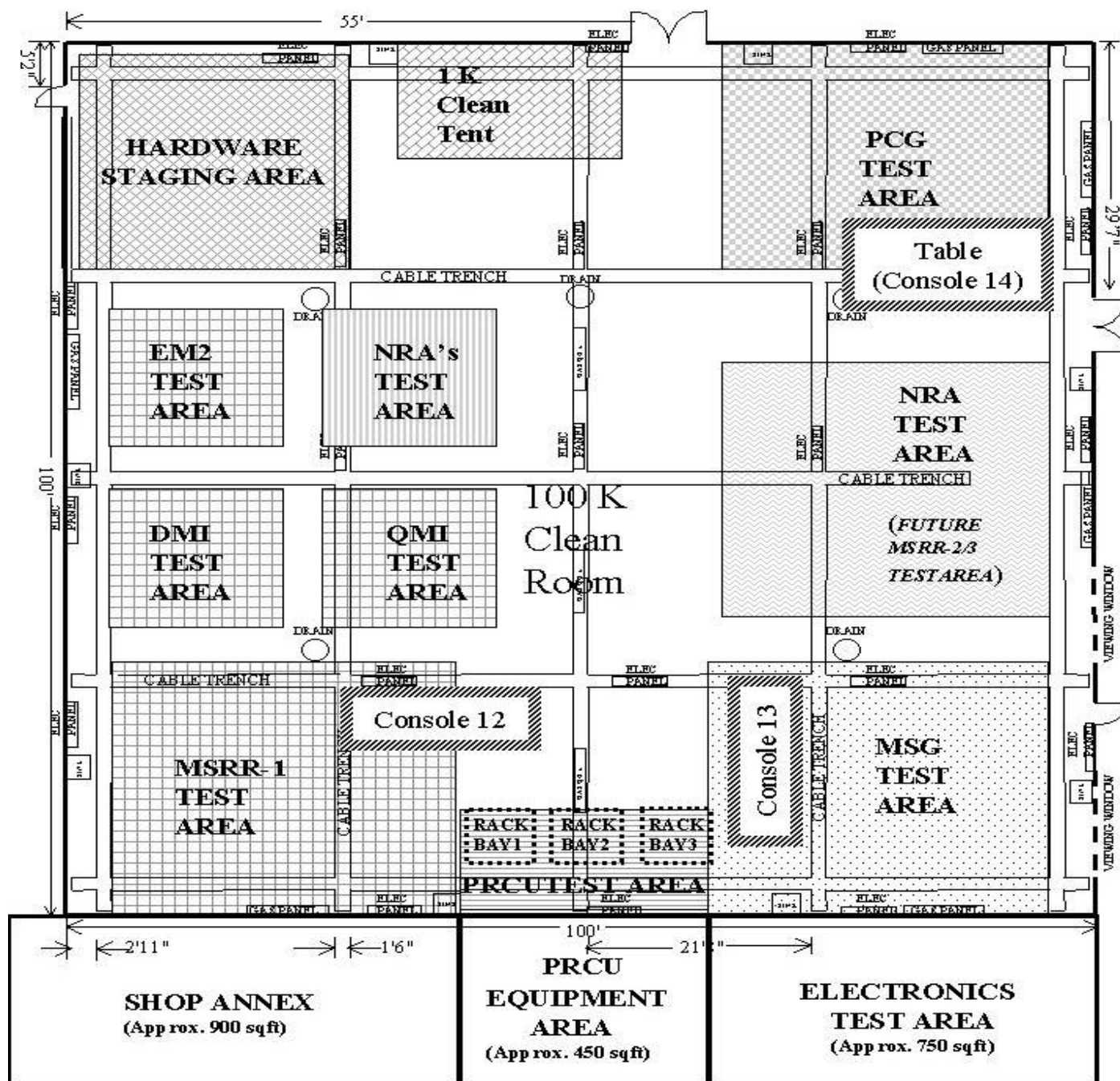


Figure 3-3 Building 4493 High Bay / Clean Room



### Figure 3-4 TSC Overall Diagram

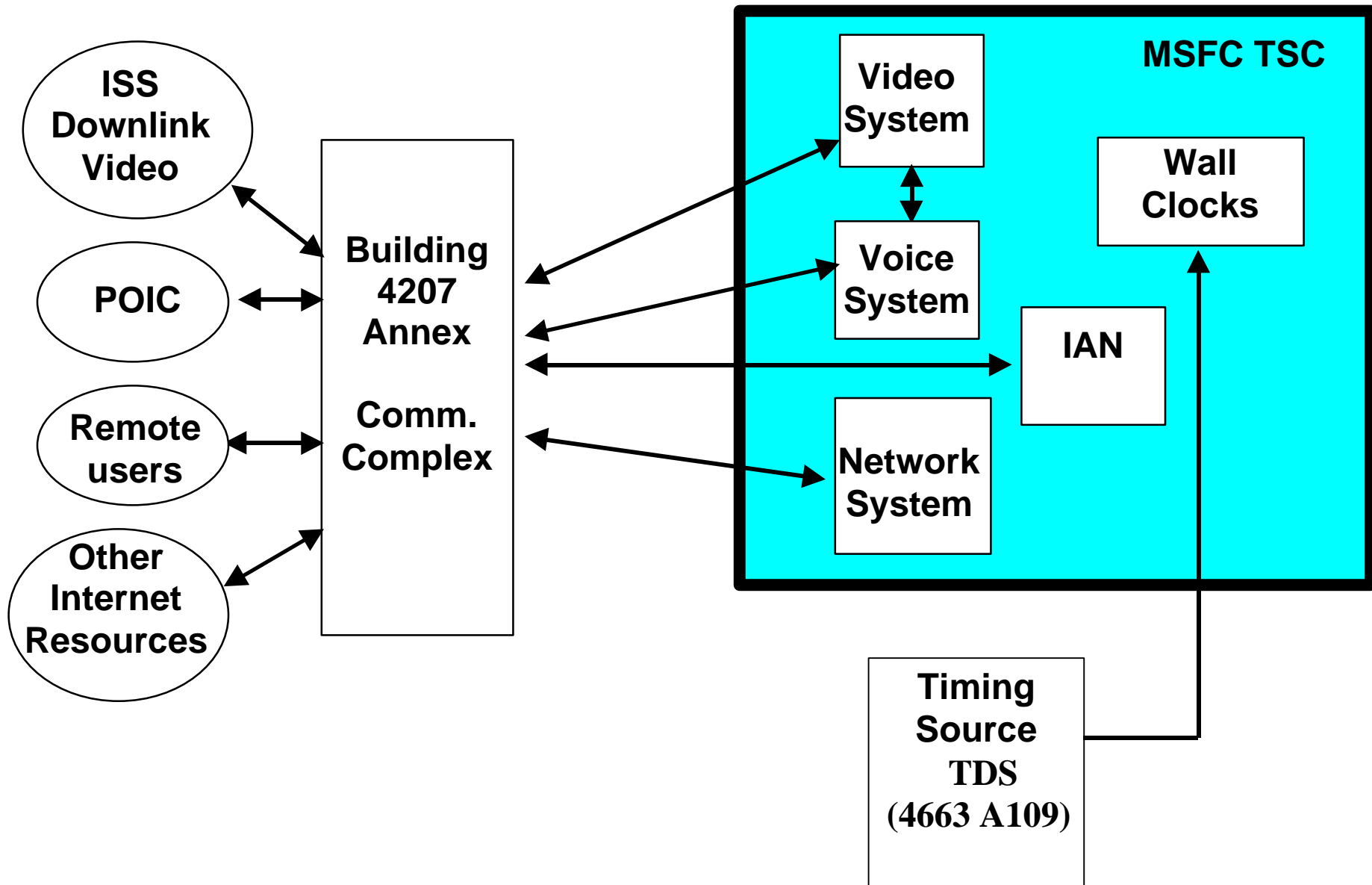


Figure 3-5 Voice System Diagram

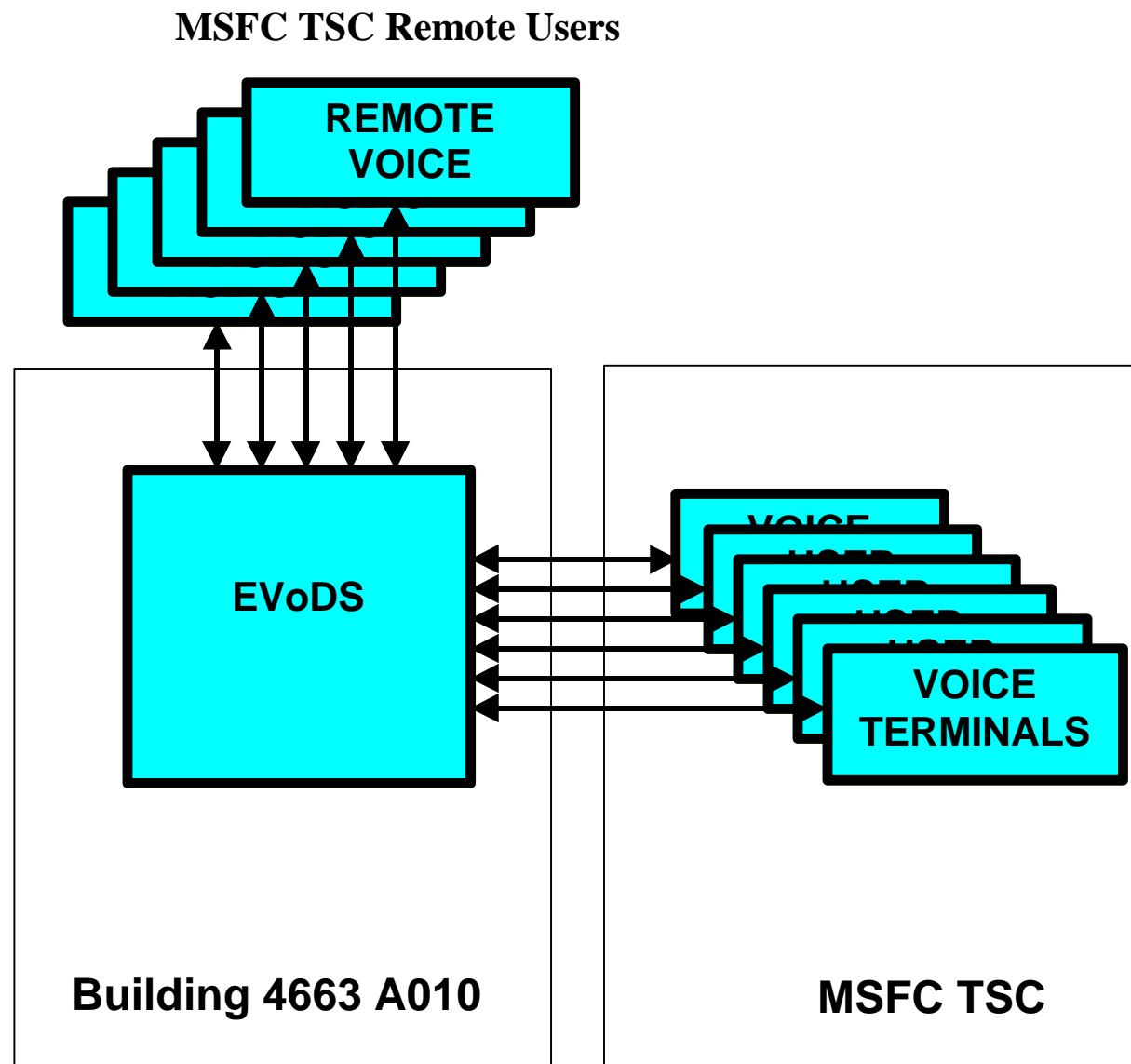


Figure 3-6 Video System Diagram

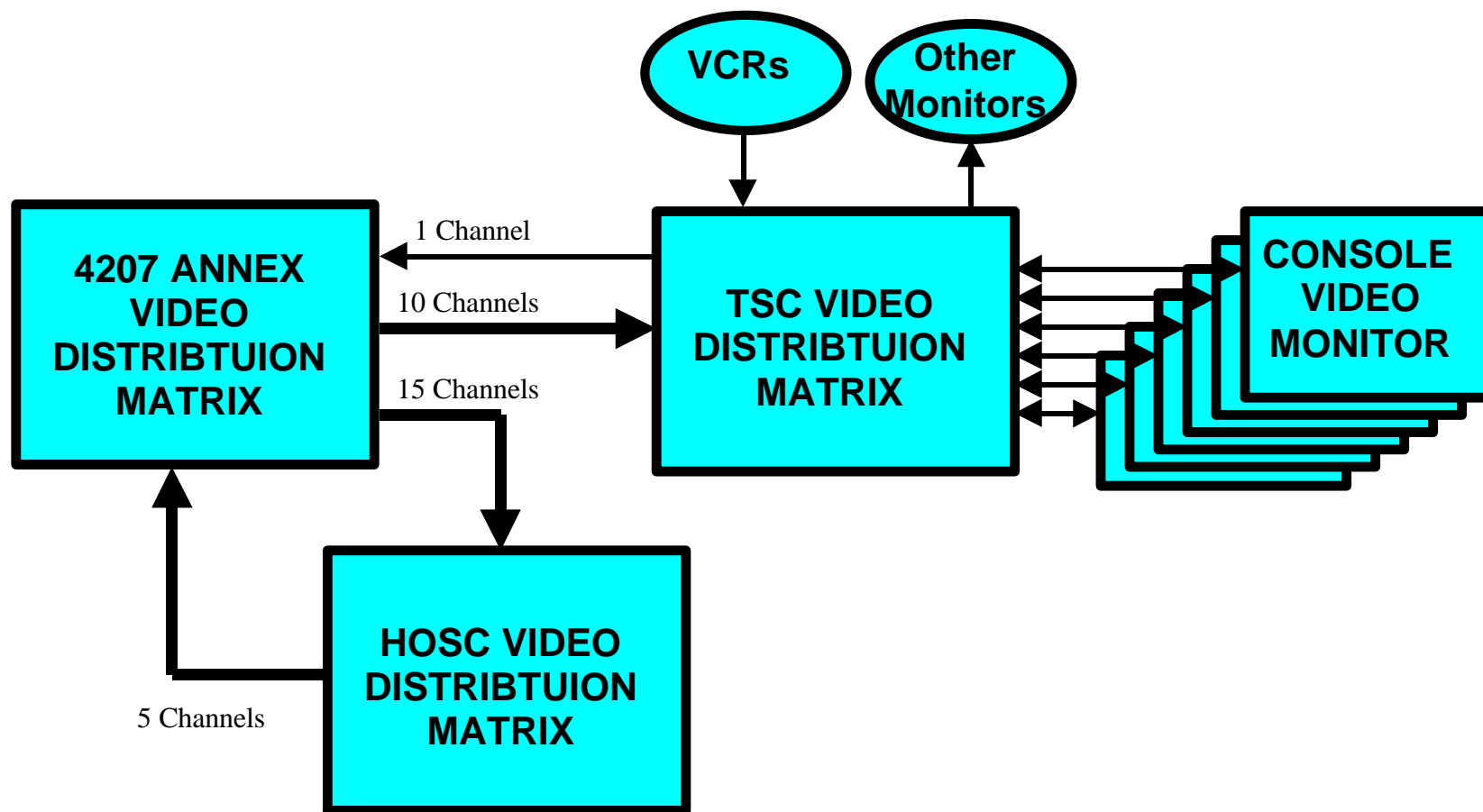
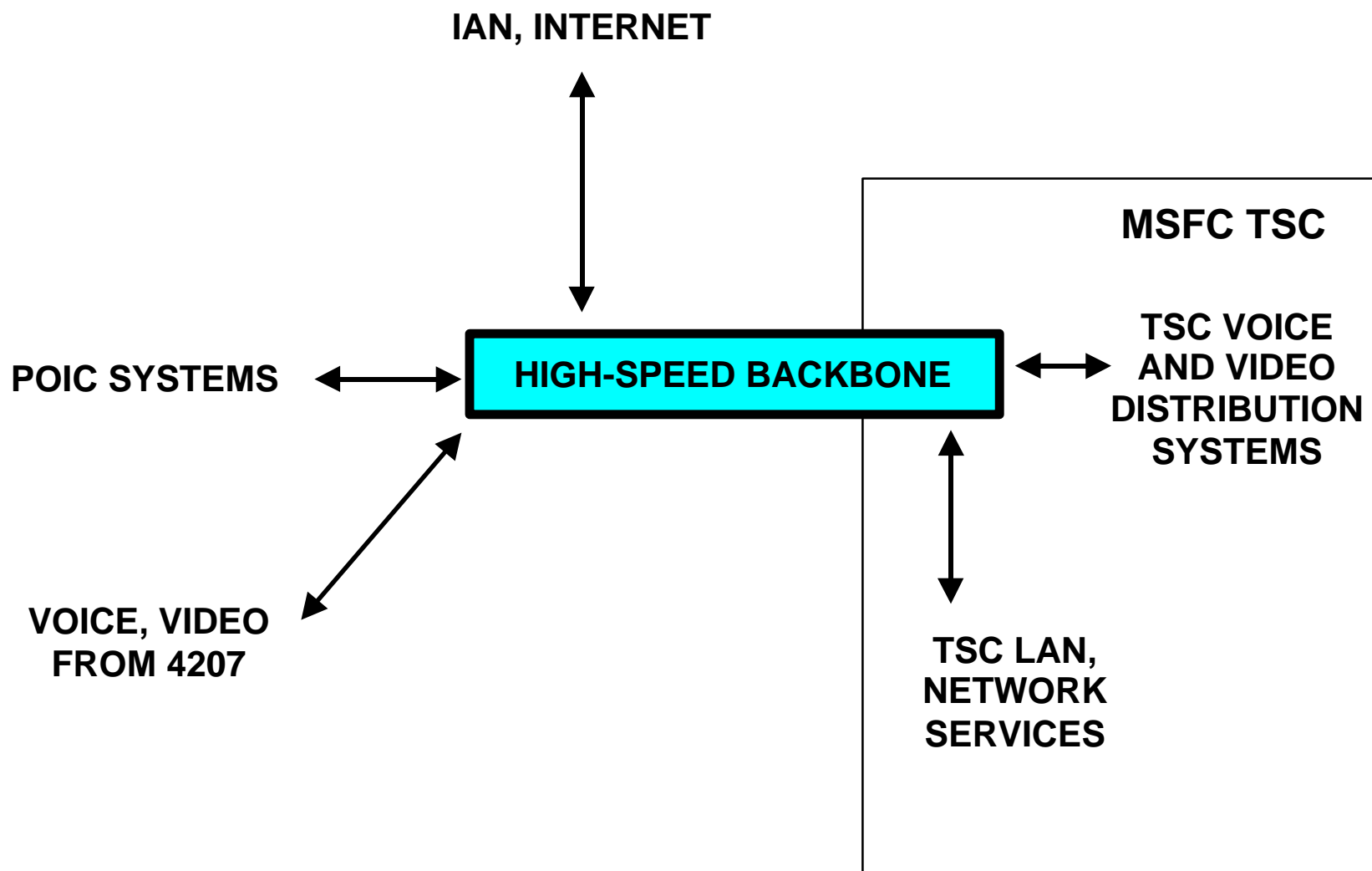
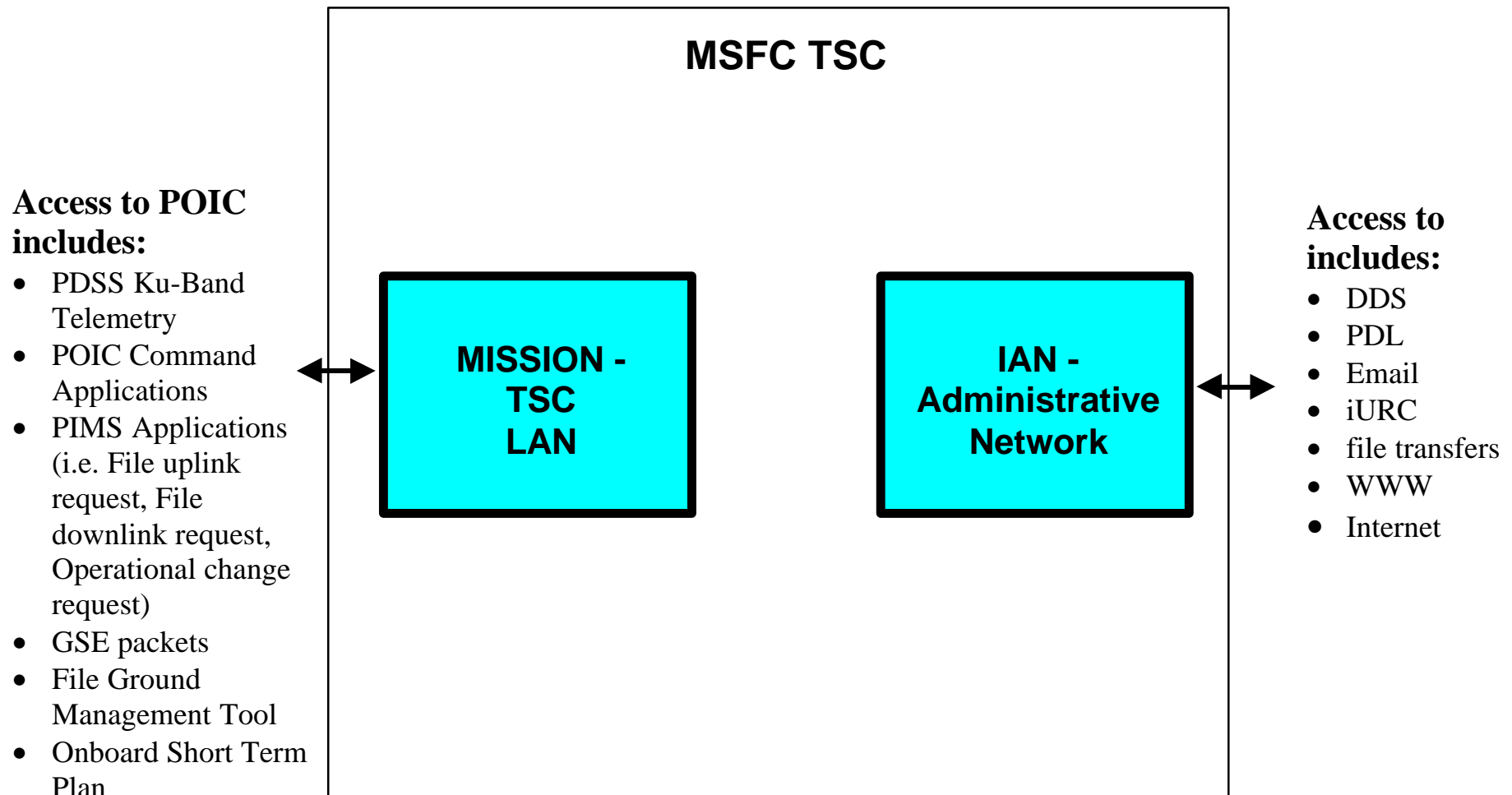


Figure 3-7 Enhanced Mission Communication System Diagram



**Figure 3-8 Networking System Diagram**



## **4 SYSTEM REQUIREMENTS**

This section contains the requirements for the voice, video, network and timing systems. These requirements are only applicable to the three TSC rooms, 120, 122, and 124, the High-Bay, and any required interconnectivity.

### **4.1 Overall TSC Requirements**

- a. The TSC shall support continuous on-orbit operations with scheduled or unscheduled downtimes of up to 12 hours allowed
- b. The TSC shall support limited and scheduled activities which include simulation, training, and testing and validation independent of other operations.
- c. The TSC shall support two independent, simultaneous, on-line operations (i.e. one ISS real-time and one ISS simulation operation).

#### **4.1.1 MSFC TSC External Interfaces**

- a. The MSFC TSC shall connect to the following facilities, as appropriate, to conduct operations:
  1. MSFC TSC to POIC

#### **4.1.2 TSC Network Access**

- a. The TSC shall provide access to the following networks:
  1. POIC Networks
  2. TSC Mission LAN
  3. IAN

### **4.2 Voice System**

- a. The TSC shall provide a voice keyset at each console position with the following capabilities:
  1. Talk on one loop at a time.
  2. Access to a minimum of 18 voice loops.
  3. Monitor a minimum of 18 voice loops simultaneously.
- b. Each console keyset shall provide voice access to 18 voice loops.
- c. Each console keyset shall be expandable to 48 voice loops, as required.
- d. The TSC shall provide connectivity to the POIC Voice Switch.
- e. The TSC shall provide access to the following classes of voice loops:
  1. Space-to-ground voice loops (ISS)
  2. Air-to-ground voice loops (STS)
  3. Ground-to-ground voice loops
  4. TSC generated audio sources
  5. TSC Remote Users

### **4.3 Video System**

- a. The TSC shall provide connectivity to the POIC video distribution switch.

#### **4.3.1 Input Sources**

- a. The TSC video system shall receive a maximum of 10 video channels from the ALS video transport system. Five video channels can be provided from the POIC.



Ten video channels can be provided from 4207 Annex. The combination of video channels from the POIC and 4207 Annex may not exceed 10.

- b. The TSC video system shall receive a maximum of 16 video channels from within the TSC.

#### **4.3.2 Video Monitors**

- a. Each user console shall be equipped with one 13" video monitor as required.
- b. Each user console shall be equipped with the capability to select from the 10 video input sources for display.

#### **4.3.3 Distribution**

- a. The TSC video system shall distribute video to 32 destinations within the TSC.
- b. The TSC video system shall forward one video channel to the POIC video distribution switch.

#### **4.3.4 Video Recording**

- a. The TSC video system shall provide a video cassette recorder at each console to record user defined events, as required.

#### **4.4 Enhanced Mission Communication System**

- a. The MSFC TSC shall provide access to the EMCS network.
- b. The POIC voice +1 shall be routed via EMCS.
- c. The out of band network management shall be routed via EMCS.
- d. The TDS GMT Timing shall be routed via EMCS.

#### **4.5 MSFC TSC Local Area Networks**

##### **4.5.1 TSC Mission Network**

- a. The TSC Mission Network shall provide access to the POIC for data transfer, commanding and other mission services.
- b. The TSC Mission Network shall be accessible from Rooms 120, 122, and 124.
- c. The TSC Mission Network shall be accessible from the Clean Room.
- d. Each console shall at a minimum provide one network connection to the TSC Mission Network.

##### **4.5.2 Institutional Area Network**

- a. The MSFC TSC shall provide network access to the IAN with a minimum of one drop at each console.

#### **4.6 Overall Data System Requirements**

No requirements exist at this time.

**4.7 Timing System**

- a. The TSC shall provide wall clocks for users to view GMT or other timed events, as required.

**4.8 Facility Requirements**

- a. The TSC shall provide furniture complements to support 14 user positions for operations, simulations, training, and other related activities at the TSC.
- b. The TSC shall provide network printers, one at each console, and associated support hardware and software (i.e. spooler).

**4.8.1 Facility Capacity**

- a. The TSC shall support the operations requirements as follows:
  - 1. Flight Operations Room of **624** square feet
  - 2. Simulation Room of **170** square feet
  - 3. Equipment Room **289** square feet

**4.8.2 Facility Heating, Ventilation, and Air Conditioning**

- a. The TSC shall provide heating, ventilation, and air conditioning (HVAC) to all areas.

**4.8.3 Facility Electrical Power**

- a. The TSC shall provide electrical power to all areas.
- b. Diesel power generators shall provide electrical power to TSC components in the event commercial power is lost.
- c. Uninterruptable Power Supplies shall provide electrical power to TSC components during the timeframe between the loss of commercial power and the activation of the diesel generators.

**4.8.4 Furniture Accommodations**

- a. The TSC shall provide accommodations, such as consoles or tables, chairs, phones, storage cabinets, for its users in the operations areas.

**4.9 Facility Operations Support**

This section describes the types of support that the TSC will provide.

**4.9.1 Operations Support at the TSC****4.9.1.1 Pre-Increment Support at TSC**

- a. The TSC, as an extension of the HOSC, shall provide support for experiment pre-increment operations including simulations, ground support personnel training and pre-increment configuration on TSC-furnished equipment.
- b. These activities shall be supported during day shift.
- c. Continuous support for simulations shall be provided when required.

**4.9.1.2 Increment Support at TSC**

- a. The TSC shall support experiment increment operations on a continuous basis for experiment teams at the TSC when required.

**4.9.2 TSC Equipment RMA requirements**

- a. The TSC shall adhere to the Reliability, Maintainability, and Availability (RMA) requirements documented in the Payload Capabilities Document (PCD) Chapter 12.

**4.10 Security**

- a. The TSC shall adhere to the security requirements in the PGUIDD (SSP 50305).
- b. The TSC shall adhere to the security requirements in MPG 1600.1 and MPG 2810.1.

**4.11 Training and Certification**

**4.11.1 Ground Support Personnel Training**

- a. The TSC shall provide a certified trainer and training, for all TSC users, on the use of the following TSC provided equipment.
  - 1. Voice Keysets
  - 2. Video Monitors and RCPs

**4.11.2 Certification**

The TSC shall certify that all facility provided equipment, the configuration, and functionality are ready to support flight operations.

## **5 VERIFICATION**

The requirement source verification and requirement verification methods are in Table 5.1

TSC REQUIREMENT	SOURCE	VERIFICATION METHOD
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**A. ACRONYM LISTING**

EMCS	Enhanced Mission Communication System
GMT	Greenwich Mean Time
HVAC	Heating, Ventilation, and Air Conditioning
HOSC	Huntsville Operations Support Center
IAN	Institutional Area Network
IGSS	International Ground Systems Specifications
ISS	International Space Station
ISSPO	International Space Station Program Office
IURC	Interim User Requirement Collection
LAN	Local Area Network
MDL	Microgravity Development Lab
MSAD	Microgravity Science and Applications Department
MSFC	Marshall Space Flight Center
NASA	National Aeronautics and Space Administration
PACRATS	Payloads and Components Real-Time Automated Test Systems
PDL	Payload Data Library
PIMS	Payload Information Management System
POIC	Payload Operations Integration Center
RMA	Reliability, Maintainability, and Availability
STS	Space Transportation System (Space Shuttle)
TBD	To Be Determined
TBR	To Be Resolved
TSC	Telescience Support Center

**B. UNRESOLVED AND UNDEFINED ITEMS**

**TBD'S**

**TBD01** –Determine TSC RMA requirements.

**TBR'S**

**C. Possible Future Requirements**

- 1) Provide a mass storage capability for all the TSC users to write to.
- 2) Add video telecon capability in room 101 to support ISS operations
  - a) Shared requirement with MDL.
  - b) Remote site to TSC Video interface.
- 3) Voice recording for space-to-ground loop.
- 4) Provide a direct network connection between the MSFC TSC and JSC.
- 5) Provide general video monitor capability in both user rooms.